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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 09/858,337
Filing Date: May 15, 2001
Appellant(s): SCHAFF ET AL.

Bradley A. Forest
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed January 25, 2006 appealing from the Office action mailed June 6, 2005.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

**Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Huang et al. (US 5,719,088).**

Huang et al. ("Huang"), cited in the previous Office Action, discloses a method of forming a channel heterojunction field effect transistor [see FIG. 1-6] comprising the steps of: forming a channel heterojunction field effect transistor having a top surface; and applying an AlN layer 25 to the top surface of the heterojunction field effect transistor 20. Huang et al. states at column 3, lines 55-59 that the AlN layer 25 is being employed as an etch stop layer to ensure that the etching process stops at the AlN layer 25 and reduces the possibility of incidental damage inherently to the layers below. Since the AlN etch stop layer 25 also functions as a protective layer for the layers below during the etching process as previously disclosed, it is appropriate to refer to such layer as a "passivation layer".

**Claims 2, 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Yoshida (U.S. 6,281,099).**

Huang discloses a method of forming an AlN layer on a channel heterojunction field effect transistor previously as described, which method is repeated herein.

Re claims 2, 5 and 9, Huang fails to show using a molecular beam epitaxy process (MBE) to form the AlN layer to a desired thickness of approximately 500 to 2000 angstroms.

Yoshida, cited in the previous Office Action, suggests forming an AlN layer using MBE wherein beams of Al and RF nitrogen are appeared to be applied simultaneously until a desired thickness between 0.05-1.0 microns (50-10,000 angstroms) is obtained [see col. 2, lines 45-48].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Huang with the teaching of Yoshida by forming an AlN layer

using MBE processing, since Yoshida stated at column 1, lines 32-36, that such modification would provide an AlN layer having low resistivity and excellent in electrical conductivity and thermal conductivity.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a thickness for the AlN layer within the range as suggested by Yoshida, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

**Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Parmenter et al. (U.S. 5,026,454).**

Re claims 3 and 4, Huang fails to show Al and N being applied alternately until a desired thickness of AlN is obtained.

Parmenter et al. ("Parmenter") teaches in FIG. 1 an MBE apparatus that utilizes shutters 21 and 24 to alternately open and close molecular or atomic beam sources 1 and 2, wherein the beams 1 and 2 are alternately applied for approximately 0.2 seconds or less, or for any length of time required by the deposition process [see col. 2, lines 52-65].

Since Huang and Parmenter are both from the same field of endeavor, the purpose disclosed by Parmenter would have been recognized in the pertinent prior art of Huang.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Huang with the teaching of Parmenter, since Parmenter states at column 1, line 34 to 35 that such modification would achieve accurate dosage of material at the substrate.

**Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Yoshida as applied to claims 2, 5 and 9 above, and further in view of Parmenter.**

Re claims 6-8, the combined disclosure of Huang and Yoshida fails to disclose alternately applying Al and RF nitrogen beams at a predetermined amount of time between the alternating beams.

Parmenter et al. ("Parmenter") teaches in FIG. 1 an MBE apparatus that utilizes shutters 21 and 24 to alternately open and close molecular or atomic beam sources 1 and 2, wherein the beams 1 and 2 are alternately applied for approximately 0.2 seconds or less, or for any length of time required by the deposition process [see col. 2, lines 52-65].

Since Huang, Yoshida and Parmenter are from the same field of endeavor, the purpose disclosed by Parmenter would have been recognized in the pertinent prior art of Huang and Yoshida.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined process of Huang and Yoshida with the teaching of Parmenter, since Parmenter states at column 1, line 34 to 35 that such modification would achieve accurate dosage of material at the substrate.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a process time between alternating beams as taught by Parmenter, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

**Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utumi in view of Parmenter and Yoshida.**

Utumi discloses method of forming a layer of AIN of desired thickness [see col. 6, lines 62 to col. 7, lines 12] on a semiconductor substrate, the method comprising: using molecular beam epitaxy (MBE): applying beams of A1; and applying beams of remote plasma RF nitrogen with the beams of Al to produce the layer of AIN of desired thickness.

Re claim 11-15, Utumi fails to disclose alternately applying the beams of remote plasma RF nitrogen and the beams of Al at specific process parameters such as time and thickness as claimed.

Parmenter et al. ("Parmenter") teaches in FIG. 1 an MBE apparatus that utilizes shutters 21 and 24 to alternately open and close molecular or atomic beam sources 1 and 2, wherein the beams 1 and 2 are alternately applied for approximately 0.2 seconds or less, or for any length of time required by the deposition process [see col. 2, lines 52-65].

However, Parmenter fails to mention any specific desired thickness of the AlN layer.

Yoshida, as previously discussed above, suggests forming an AlN layer using MBE until a desired thickness between 0.05-1.0 microns (50-10,000 angstroms) is obtained [see col. 2, lines 45-48].

Since Utumi, Parmenter and Yoshida are all from the same field of endeavor, the purposes disclosed by Parmenter and Yoshida would have been recognized in the pertinent prior art of Utumi.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Utumi with the teaching of Parmenter, since Parmenter states

at column 1, line 34 to 35 that such modification would achieve accurate dosage of material at the substrate.

It further would have been obvious to one of ordinary skill in the art at the time the invention was made to select specific process parameters such as time and thickness within the ranges as combinatively suggested by Utumi, Parmenter and Yoshida, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

**(10) Response to Argument**

**A) Discussion of the rejection of claim 1 under 35 U.S.C. 102(b) as being anticipated by Huang et al. (US 5,719,088).**

Appellant argues that the passivation layer described in the specification is formed directly on top of the HFET, and not on additional layers. In response, the Examiner respectfully disagrees because claim 1 does not specifically require the AlN passivation layer to be applied directly on top of the entire top surface of an HFET. Claim 1 merely recites "applying an AlN passivation layer to the top surface of the heterojunction channel field effect transistor". Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Regardless, Huang expressly shows in FIG. 6 an AlN layer 25 is applied to a top surface (layer 22) of an HFET, wherein the HFET comprises layers 14, 12, 22 and 40.

Appellant argues that the AlN layer 25 in the Huang reference "is never used as a passivation layer, it is only used as an etch stop layer in an intermediate processing step". In

response, the Examiner respectfully disagrees because the AlN layer 25 of Huang does not have to be used as a passivation layer. Regardless, it can be seen in FIG. 6 that the AlN layer 25 remains on a top surface 22 of HFET to provide additional passivation function to the HFET in addition to the passivation film 35.

B) **Discussion of the rejection of claims 2, 5 and 9 under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Yoshida (U.S. 6,281,099).**

Appellant argues that since neither Huang nor Yoshida describes the use of an AlN layer as a passivation layer, the thicknesses of AlN as described by Yoshida are irrelevant to the thickness of an AlN passivation layer. In response, the Examiner respectfully disagrees because, as previously discussed above, Huang shows the use of the remaining AlN layer 25 as an additional passivation layer to the HFET. Thus, it is not at all irrelevant to optimize the thickness of such an AlN passivation layer in the manner as suggested by Yoshida. Furthermore, since Yoshida was used to specifically show the use of MBE to form an AlN layer, Yoshida does not have to specifically state that AlN is a passivation layer.

C) **Discussion of the rejection of claims 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Parmenter et al. (U.S. 5,026,454).**

Appellant argues that the MBE process of Parmenter comprises "alternately opening and closing a single shutter, not alternating between two shutters to form a compound such as AlN". In response, the Examiner respectfully disagrees because Parmenter states that the MBE system "may contain several beam sources each having such a shutter and control mechanism, as may be required for dosing a substrate with several materials in sequence, or simultaneously" (emphasis added) [see col. 5, lines 5-9]. Thus, it is clear that each of the shutters (21, 24) as shown in FIG.

1 of Parmenter controls a single beam source (1 or 2) of material. Parmenter further states that MBE process provides deposition of material with "monolayer thickness" [see col. 1, lines 12-16]. Therefore, when such an MBE process is employed to form an AlN layer, the beam sources of Al and N can be applied in sequence or simultaneously in order to form multiple monolayers of AlN until the desired thickness is obtained. And if the beam sources of Al and N were applied in sequence, then it is understood that Al and N would have been alternately applied. For example, consider the following alternating sequence of beam sources: Al, then N, then Al, then N, and so on.

Appellant further argues that the references do not describe "a predetermined amount of time occurs between each alternate application". In response, the Examiner respectfully disagrees because, as discussed above, Parmenter discloses the beam sources can be applied in sequence. And in order for the beam sources to be "in sequence" and not simultaneous, a "predetermined" amount of time must occurs between each application.

D) **Discussion of the rejection of claims 6-8 under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Yoshida as applied to claims 2, 5 and 9 above, and further in view of Parmenter.**

Appellant argues that Parmenter "clearly does not describe a length of time that a shutter is open as claimed in claim 6, wherein the beams are alternatively applied for approximately two seconds". In response, the Examiner respectfully disagrees because Parmenter discloses "typically the shutter is moved to open (or to close) the beam source within an opening time (or a closing time) of approximately 0.2 seconds or less ... beam source may, however, remain open (or closed) between movements for any length of time required by the deposition process"

(emphasis added) [see col. 2, lines 52-65]. Thus, it can be understood that each of the beam sources (1, 2) can be applied for approximately 0.2 seconds or less, or for any length of time required by the deposition process.

Appellant further argues that Parmenter does not describe opening or closing alternate shutters. In response, the Examiner respectfully disagrees because, as previously discussed above, when the MBE process of Parmenter is employed to form a layer, the beam sources of materials be applied in sequence or simultaneously in order to form multiple monolayers until a desired thickness is obtained. And if the beam sources of materials were applied in sequence, then it is understood that the beam sources would have been alternately applied to form the monolayers. For example, consider the following alternating sequence of beam sources: Al, then N, then Al, then N, and so on.

Appellant further argues that the references do not describe "a delay between alternate applications of the beams". In response, the Examiner respectfully disagrees because, as discussed above, Parmenter discloses the beam sources can be applied in sequence. And in order for the beam sources to be "in sequence" and not simultaneous, a "delay" must occurs between each application. In addition, Appellant further argues that the references do not describe "the lengths of time during which the beams are alternatively applied as well as the delay itself". In response, the Examiner respectfully disagrees because it would have been obvious to one of ordinary skill in the art at the time the invention was made to select processing times in the manner as taught by Parmenter, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

E) **Discussion of the rejection of claims 11-15 under 35 U.S.C. 103(a) as being unpatentable over Utumi in view of Parmenter and Yoshida.**

Appellant argues that Parmenter does not describe "a length of time that is used for forming an AlN layer" and "alternatively applying different beams to arrive at a two compound layer, such as AlN".

In response to applicant's arguments against the references individually (e.g. Parmenter), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Regardless, Parmenter was used to show that each of the beam sources (1, 2), as shown in FIG. 1, can be applied for approximately 0.2 seconds or less, or for any length of time required by the deposition process [see col. 2, lines 52-65]. Therefore, when such an MBE process is employed in the process of Utumi to form an AlN layer, Parmenter states that accurate dosage of material can be achieved at the substrate. In addition, Parmenter also shows that each of the shutters (21, 24) as shown in FIG. 1 of Parmenter controls a single beam source (1 or 2) of material. Parmenter further states that MBE process provides deposition of material with "monolayer thickness" [see col. 1, lines 12-16]. Therefore, when such an MBE process is employed in the process of Utumi to form an AlN layer, the beam sources of Al and N are applied in sequence or simultaneously in order to form multiple monolayers of AlN until the desired thickness is obtained [see col. 5, lines 5-9]. And if the beam sources of Al and N were applied in sequence, then it is understood that Al and N would have been alternately applied.

For example, consider the following alternating sequence of beam sources: Al, then N, then Al, then N, and so on.

Appellant further argues that the references do not describe "a delay between alternate applications of the beams". In response, the Examiner respectfully disagrees because, as discussed above, Parmenter discloses the beam sources can be applied in sequence. And in order for the beam sources to be "in sequence" and not simultaneous, a "delay" must occurs between each application.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Parmenter teaches alternately apply different beam sources in an MBE process, and Yoshida teaches forming an AlN layer using MBE until a desired thickness is obtained.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Khanh Duong

Zandra V. Smith
Supervisory Patent Examine
4/19/2000

Conferees:

Zandra Smith, SPE, GAU 2822 Date: 4/19/2006

Drew Dunn, SPE, GAU 2872 Date: 4/12/06

KBD Khanh Duong, Examiner, GAU 2822 Date: 4/18/2006